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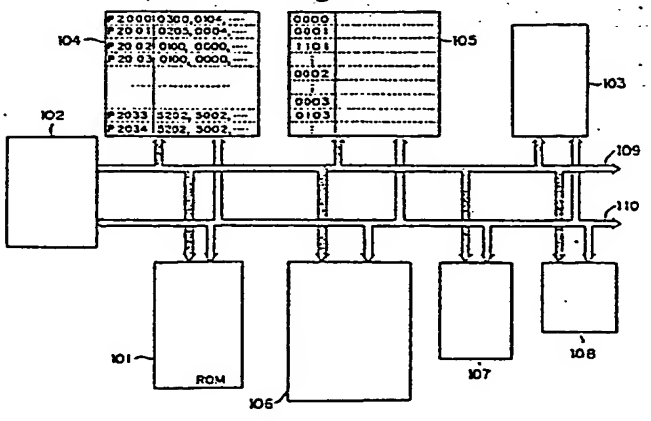
(54) METHOD OF AUTOMATICALLY PREPARING NUMERICAL CONTROL DATA.

(57) A method of automatically preparing numerical control data comprises: providing a multiplicity of parameters (P2000 to P2034) which are used for specifying a machining pattern, and a multiplicity of function codes for preparing numerical control data, the function codes being specified by the parameters; prestoring in a memory (105) a corresponding relationship between each function code and a numerical control data output mode; prestoring in another memory (104) a corresponding relationship between each parameter and one or more function codes specified by that parameter; successively inputting the parameters to a processor (102) from a machining pattern data output device (103) in accordance with NC machining; and preparing numerical control data by employing the function codes specified by the parameters.

Fig. 1



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DESCRIPTION

METHOD OF CREATING NUMERICAL CONTROL DATA AUTOMATICALLY

Technical Field

This invention relates to a method of creating numerical control data automatically and, more particularly, to a numerical control data automatic creation method wherein an NC tape format can be changed with ease.

Background Art

A numerical control apparatus (NC apparatus) controls a machine tool on the basis of commanded numerical control data (NC data) in order to machine a workpiece in conformance with a command. The NC data (also referred to as an NC tape) is created by programming performed by a programmer, or by a unit for creating NC data automatically. With an NC data automatic creation unit, even NC data for a complicated metal mold can be created. The NC data automatic creation unit is designed so that NC data can be created simply and in a short period of time.

In the conventional method of creating NC data, the NC tape format cannot be readily changed. In other words, the conventional NC data creation method can create an NC tape in accordance with one format but not in accordance with another. Therefore, when an NC tape format is desired to be changed in order to add a special function to a machine tool or to have a machine tool execute control tailored to a particular user, the

user must purchase a separate NC data creation unit for the new NC format. Consequently, the user is compelled to prepare an NC data creation unit whenever the format changes, and the maker of the NC data creation unit must supply NC data creation units having different formats.

Accordingly, the object of the present invention is to provide an NC data automatic creation method wherein NC tapes can be created for different formats.

Another object of the present invention is to provide an NC data automatic creation method wherein an output NC tape format can be changed with ease.

A further object of the present invention is to provide an NC data automatic creation method through which NC tapes having different formats can be created by a single NC data automatic creation unit, so that NC data creating units need not be prepared for different formats.

Disclosure of the Invention

The present invention provides an NC data automatic creation method in which an NC tape format can be changed with facility. The method includes providing a number of parameters used for specifying a machining pattern and a number of function codes designated by the parameters for creating numerical control data, storing beforehand correspondence between each of the function codes and a numerical control data output format, storing beforehand correspondence

between each parameter and one or more function codes designated by the parameter, generating the parameters sequentially in accordance with NC machining, and creating numerical control data using function codes designated by the parameters. According to the present invention, an NC data format can be changed with ease by changing a function code designated by a parameter.

Brief Description of the Drawings

Fig. 1 is a block diagram illustrating an embodiment of the present invention, Fig. 2 is a flow chart of processing according to the present invention, Fig. 3 is a view for explaining the relation between various parameter numbers and their meanings according to the present invention, Fig. 4 is a view of a turning machining pattern, Fig. 5 is a view for explaining the correlation between parameter numbers and various function codes, and Fig. 6 is a view for explaining the correlation between function codes and NC data output formats.

Best Mode for Carrying Out the Invention

Fig. 1 is a block diagram illustrating an embodiment of the present invention. Numeral 101 denotes a ROM which stores a control program for NC data creation, 102 a processor for executing predetermined processing under the control of the control program, and 103 a machining pattern information output unit for specifying a general machining pattern. As will be described later, a

machining pattern is expressed by parameter numbers P2000 through P2034, positional data, tool numbers, spindle r.p.m., etc. For a lathe, the parameter numbers have the meanings shown in Fig. 3. By combining these parameter numbers, the general nature of a machining pattern can be expressed. By way of example, the following would express a machining pattern, shown in Fig. 4, for moving a tool from a machine reference point Pr to a tool change point Pt, changing the tool at the tool change point, rotating a spindle at a predetermined speed, thereafter causing the tool to approach a point Pa and subsequently perform rough cutting along a cutting path comprising straight lines and circular arcs, retracting the tool to the tool change point Pt upon completion of rough cutting, and finally moving the tool to the machine reference point:

P2000 } .... (a)
P2016 }

P2017 .... (b)

P2004 }
P2016 } .... (c)
P2024 }

P2018 .... (d)

P2017 .... (e)

P2020 .... (f)

P2019 .... (g)

P2011 .... (h)

P2017 .... (i)

where (a) through (i) above correspond to (a) through (i) in Fig. 3. Specifically, parameter number P2000 of (a) indicates that an NC data leader portion is to be created, parameter number P2016 of (a) that a coordinate system is to be set, parameter number P2017 of (b) that the tool is to be moved from the machine reference point Pr to the tool change point Pt, parameter number P2004 of (c) that NC data for outer diameter rough cutting are to be created, parameter number P2016 of (c) that NC data (T-function instruction) for a tool change are to be created, parameter number P2024 of (c) that NC data (S-function instruction) for selecting spindle speed are to be created, parameter number P2018 of (d) that NC data for moving the tool to the approach point Pa and for turning on a coolant are to be created, parameter P2017 of (e) that NC data for linear cutting are to be created, parameter P2019 of (g) that NC data for retracting the tool to the tool change point Pt and for turning the off the coolant are to be created, parameter number P2011 of (h) that NC data for processing following outer diameter rough machining are to be created, and parameter number P2017 of (i) that NC data for moving the tool to the machine reference point Pr are to be created.

Returning to Fig. 1, numeral 104 denotes a battery-backed RAM for storing the correspondence

between each of the parameter numbers P2000 through P2034 and one or more function codes indicated by the parameter numbers. Fig. 5 illustrates the relation between parameter numbers for a lathe and a plurality of function codes F1 through F9 indicated by the parameter numbers. A function code is expressed by a four-digit hexadecimal number and specifies the format of the output NC data. The rightmost digit 0 - A of a function code indicates the general category, while the three leftmost digits indicate the particular category. Further, a rightmost digit of 0 signifies an output of NC data for a special code, of 1 an output of NC data for movement, of 2 an output of a G-code, of 3 an output of an F-code for feed speed, an output of an S-code for spindle speed selection and an output of a T-code for a tool change, of 4 an output of a special code, of 5 an output of an M-code, of 6 an output of a special M-code, of 7 an output of a code of value 0, of 8 an output of any M-code other than the M-codes output in accordance with the rightmost digits of 5 and 6, of 9 an output of any S-code, and of A an output of any T-code.

Numeral 105 designates a battery-backed RAM for storing the correspondence between each of the function codes and an NC data output format. Such correspondence is illustrated in Fig. 6. Though Fig. 6 shows only the correspondence between function codes needed to create NC data for the turning machining pattern of

Fig. 4 and the NC data output formats, many other function codes are stored without being limited to those shown. Numeral 106 denotes an NC data memory for storing the NC data created, 107 a working memory, and 108 an operator's panel.

Reference will now be had to the flowchart of Fig. 2 to describe a case where NC data for the turning machining shown in Fig. 4 is created.

(1) First, the correspondence (see Fig. 5) between the parameter numbers P2000 through P2034 and the one or more function codes F1 through F9 indicated by these parameter numbers, is stored beforehand in the RAM 104, and the correspondence (see Fig. 6) between each of the function codes and NC data output formats is stored beforehand in the RAM 105.

(2) When the operator's panel 108 gives an indication calling for the start of NC data creation, the processor 102 reads a machining pattern, which is formed of the parameter numbers, out of the machining pattern information output unit 103 in block-by-block fashion. Machining pattern data shown below enter the processor 102 block by block from the output unit 103:

P2000, program number;
P2016, [Xr], [Zr], [Sr]; } .... (a)

P2017, [Xt], [Zt], rapid traverse, absolute; .... (b)

P2004 ;
P2016, [Ta] ; } .... (c)
P2024, [Sa] ;

P2018, [Xa], [Za], rapid traverse .... (d)

P2017, linear cutting position data, [Fa] ; } .... (e)

.....

P2020 arc cutting position data, [Fa] ; } .... (f)

.....

P2019, [Xt], [Zt], rapid traverse ; .... (g)

P2011 ; .... (h)

P2017, [Xr, Zr], rapid traverse ; .... (i)

These enter the processor sequentially. The following are input to the processor together with the parameter numbers: the program number, coordinate values [Xr], [Zr], [Xa], [Za], [Xt], [Zt] of the important points, tool code number [Ta], S-code numbers [Sr], [Sa], information indicative of rapid traverse or cutting feed (cutting feed speed is indicated by [Fa]), cutting contour data, data indicative of an absolute command or incremental command, etc.

(3) Each time one block of machining pattern data is read, the processor 102 goes to the RAM 104 and reads into the working memory 107 the function code group corresponding to the parameter number contained in the block of data. Thereafter, the processor 102 goes to the RAM 105 and reads out the output format of each function code, creates NC data and writes the NC data into the NC data memory 106.

Thus, when the first block of machining pattern information enters, the processor 102 goes to the RAM 104 to read out the following function code group

indicated by the parameter number P2000:

"0300, 0104, 0004, 0603, 0004, 0000, 0000,
0000, 0000, 0000, 0000"

The processor sets these in the working memory. Next, by referring to the NC data output format (feed output) indicated by the first function code "0300", the processor stores a feed code or space code of three units in the NC data memory (RAM) 106.

Thereafter, the processor 102 refers to the output format (output of % code) indicated by the second function code "0104" and stores the % code in the RAM 106. When the output of the % code is completed, the processor 102 refers to the output format (output of EOB [end of block] code) indicated by the third function code "0004" and stores the EOB code in the RAM 106. The processor then refers to the output format (program number output) indicated by the fourth function code "0603" and stores in the RAM 106 the letter of the alphabet "O", which indicates that the numerical to follow it is a program number, as well as the program number, which is contained in the first block of machining pattern information. After the output of the program number, the processor 102 outputs the EOB code in response to the fifth function code "004". When the data corresponding to all of the function codes read out of the working memory 107 are subsequently delivered as outputs in the foregoing manner, NC data conforming to one block of machining

pattern information will have been stored in the RAM 106. It should be noted that NC data indicative of a three-unit feed code % EOB O 1001 EOB are created by the foregoing processing.

When the creation of NC data based upon the first block of machining pattern information ends, the processor 102 reads the next block of machining pattern information out of the machining pattern information output unit 103, stores the information in the working memory 107 and executes processing just as described above. Specifically, the processor 102 goes to the RAM 104 to read out the following function code group corresponding to the parameter number P2016 of the second block, and stores the code group in the working memory 107:

"4402, 1101, 0001, 0303, 0004, 0002,
0103, 0004"

The processor then refers to the NC data output format (output of G50) indicated by the first function code "4402".

Next, the processor 102 refers to the NC data output format (X-axis position data output) indicated by the second function code "1101" and stores in the RAM 106 the letter of the alphabet "X", which indicates that the numerical value to follow it is a position along the X axis, as well as the X-axis position [Xr], which is contained in the second block of machining pattern information. Thereafter, the processor 102

refers to the NC data output format (Z-axis position data output) conforming to the third function code "0001" and stores in the RAM 106 the letter of the alphabet "Z", which indicates that the numerical value to follow it is a position along the Z axis, as well as the Z-axis position [Zr], which is contained in the second block of machining pattern information.

Next, the processor 102 generates an EOB code in response to the fourth function code "004", stores the code in the RAM 106, refers to the NC data output format (output of G00) of the fifth function code "0002" and stores "G00" in the RAM 106. After the "G00" output, the processor refers to the output format (output of T-code) of the sixth function code "0103". However, since the second block of machining pattern information does not contain a tool number, no output is produced and the processor produces an output of an EOB code in response to the seventh function code "0004", thereby ending processing for creating NC data in accordance with the second block of machining pattern information. Through the foregoing processing, the following NC data are created and stored in the RAM 106:

G50 X[Xr] Z[Zr] EOB G00 EOB

When processing for creating the NC data in accordance with the second block of the machining pattern ends, the third block of machining pattern information enters from the machining pattern information output unit 103.

The processor 102 goes to the RAM 104 to read out the following function code group corresponding to the parameter number P2017:

"0000, 0000, 5202, 5002, 1101, 0001
0503, 0004"

The processor sets these in the working memory 107. Then, when an output format corresponding to each and every function code is read and the output format is an X-axis position data output, NC data is created and delivered as an output with the X-axis coordinate value [Xt] of the tool change point Pt, which is input together with the parameter P2017, being disposed after the letter of the alphabet "X". Likewise, when the output format is a Z-axis position data output, NC data is created and delivered as an output with the Z-axis coordinate value [Zt] of the tool change point Pr being disposed after the letter of the alphabet "Z". It should be noted that the function code "0000" is a meaningless code which does not specify an operation, and that "5202" is a function code (Fig. 6) for outputting G90 or G91. Since "absolute" is commanded, "G90" is output. Further, "5002" is a function code for outputting G00 or G01. Since rapid traverse is commanded, "G00" is delivered as the output. Also, "0503" is a function code for outputting feed speed, and "0004"is a function code for outputting the EOB code. Naturally, "rapid traverse" and "absolute" in the machining pattern information are specified by

codes.

Owing to the third block of machining pattern information, therefore, the following are created and stored in the RAM 106:

G90 G00 X[Xt] Z[Zt] EOB

Thenceforth, and in similar fashion, the processor 102 creates NC data based on the fourth, fifth and successive blocks of machining pattern information and stores the data in the RAM 106. The end result is that the following NC data are created and stored in the NC data memory 106:

Three-unit feed code % EOB O 1001 EOB	.... P2000
G50 X[Xr] Z[Zr] S[Sr] EOB G00 EOB	.... P2016
G90 G00 X[Xt] Z[Zt] EOB	.... P2017
T[Ta] EOB	.... P2016
G97 S[Sa] M03 EOB	.... P2024
G90 G00 X[Xa] Z[Za] M08 EOB	.... P2018
G90 G01 X... Z... F[Fa] EOB ..... G90 G02 X... Z... I... J... F[Fa] EOB	.... P2017 .... P2020
G90 G00 X... Z... M09 EOB	.... P2019
G40 EOB M01 EOB	.... P2011
G90 G00 X[Xr] Z[Zr] EOB	.... P2017

When the machining pattern information output unit 103 delivers the parameter P2001 indicating the end of the machining pattern information, processing conforming to this parameter is performed to complete the NC data

creation processing.

Though a case has been described wherein the parameter numbers are generated by the machining pattern information output unit 103, the present invention is not limited to such an arrangement. Specifically, without entering parameter numbers from the machining pattern information output unit, one may enter only conditions necessary for deciding parameter numbers for starting and ending machining, approach retraction and the like, as well as the coordinate values of important points, spindle r.p.m. and T-code numbers. The processor 102 can then be made to generate the parameter numbers using these conditions.

There are situations where a user wishes to add a special function to a machine tool or have a machine tool execute control peculiar to the user's needs. Where this is the case, the tape format will differ from the standard NC tape format. According to the present invention, however, an NC tape can be created with ease in a desired NC tape format by setting beforehand function codes capable of accommodating all tape formats, and changing the correlation between the parameter numbers and various function codes in accordance with the desired tape format. Further, an NC tape format can be changed by changing the numerical control data output format based on a function code.

Industrial Applicability

According to the present invention, an NC tape

having any tape format can be created with facility, and a user need not purchase an NC tape creation unit whenever a tape format is to be changed. This is advantageous in terms of cost. Accordingly, the present invention is well-suited for application to an apparatus for creating NC data automatically.

CLAIMS:

1. A method of creating numerical control data automatically, characterized by providing a number of parameters used for specifying a machining pattern and a number of function codes designated by said parameters for creating numerical control data, storing beforehand correspondence between each of the function codes and a numerical control data output format, storing beforehand correspondence between each parameter and one or more function codes designated by said parameter, generating said parameters sequentially in accordance with NC machining, and creating numerical control data using function codes designated by said parameters.

2. A method of creating numerical control data automatically according to claim 1, characterized in that an NC data format is changed by changing the correspondence between parameters and function codes.

3. A method of creating numerical control data automatically according to claim 1, characterized by entering, together with said parameters, data necessary for creating numerical control data.

4. A method of creating numerical control data automatically according to claim 3, characterized in that data entered together with said parameters includes at least target position data along each axis, cutting path data and cutting feed speed data.

5. A method of creating numerical control data

automatically according to claim 4, characterized in that at least the following are designated by said function codes: NC data output for path control, various G-code outputs, various M-code outputs, T-code output, S-code output and end-of-block code output.

6. A method of creating numerical control data automatically according to claim 1, characterized in that an NC data format is changed by changing a numerical control data output format based on said function codes.

Fig. 1

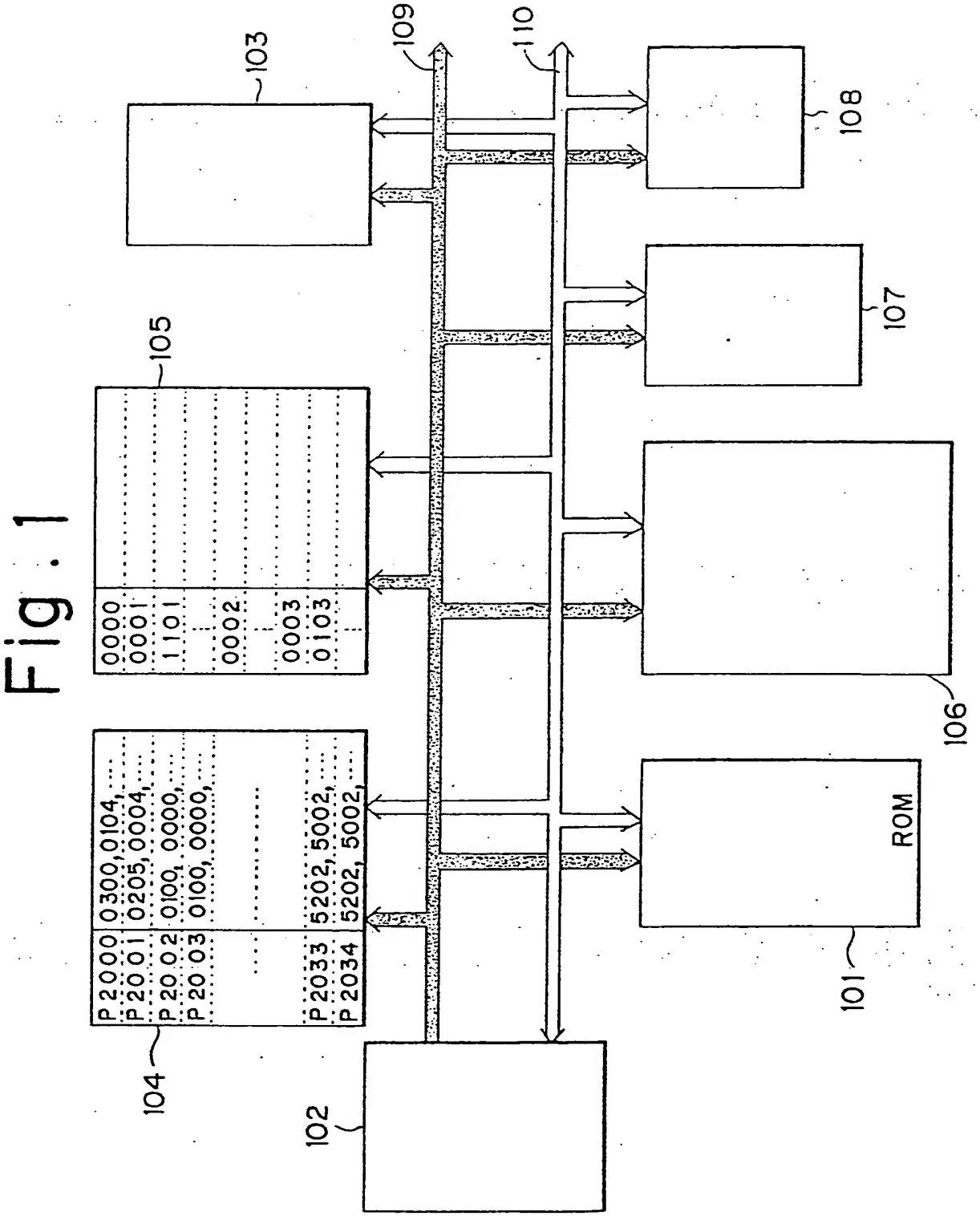

Fig. 2

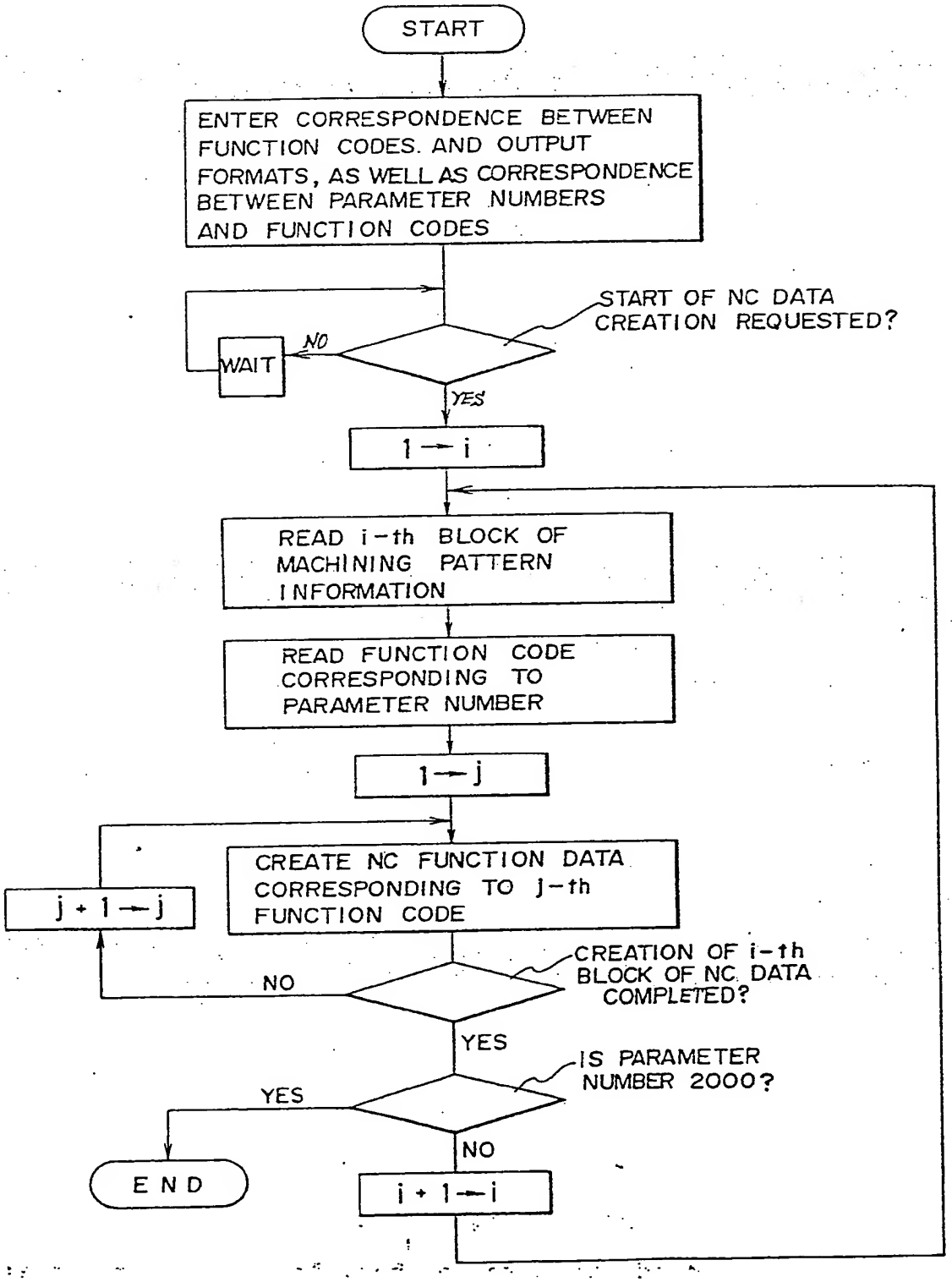

Fig. 3(A)

PARAMETER NO.	MEANING
2000	PARAMETER FOR CREATING LEADER PORTION OF NC DATA
2001	PARAMETER FOR CREATING TRAILER PORTION OF NC DATA
2002	NC DATA CREATION PARAMETER AT BEGINNING OF CENTER DRILLING PROCESS
2003	NC DATA CREATION PARAMETER AT BEGINNING OF DRILLING PROCESS
2004	NC DATA CREATION PARAMETER AT BEGINNING OF ROUGH MACHINING PROCESS
2005	NC DATA CREATION PARAMETER AT BEGINNING OF INTERMEDIATE FINISHING PROCESS
2006	NC DATA CREATION PARAMETER AT BEGINNING OF FINISHING PROCESS
2007	NC DATA CREATION PARAMETER AT BEGINNING OF GROOVING PROCESS
2008	NC DATA CREATION PARAMETER AT BEGINNING OF THREAD CUTTING PROCESS
2009	NC DATA CREATION PARAMETER AT END OF CENTER DRILLING PROCESS
2010	NC DATA CREATION PARAMETER AT END OF DRILLING PROCESS
2011	NC DATA CREATION PARAMETER AT END OF ROUGH MACHINING PROCESS
2012	NC DATA CREATION PARAMETER AT END OF INTERMEDIATE FINISHING PROCESS
2013	NC DATA CREATION PARAMETER AT END OF FINISHING PROCESS
2014	NC DATA CREATION PARAMETER AT END OF GROOVING PROCESS

PARAMETER NO.	MEANING
2015	NC DATA CREATION PARAMETER AT END OF THREAD CUTTING PROCESS
2016	PARAMETER FOR SETTING COORDINATE SYSTEM OR FOR OUTPUTTING TOOL SELECTION NC DATA
2017	NC DATA CREATION PARAMETER FOR RAPID TRAVERSE OR CUTTING FEED
2018	NC DATA CREATION PARAMETER FOR APPROACH BASED ON TWO AXES SIMULTANEOUSLY
2019	NC DATA CREATION PARAMETER FOR RETRACTION MOVEMENT BASED ON TWO AXES SIMULTANEOUSLY
2020	NC DATA CREATION PARAMETER FOR CIRCULAR INTERPOLATION
2021	NC DATA CREATION PARAMETER FOR CIRCULAR INTERPOLATION
2022	NC DATA CREATION PARAMETER FOR THREAD CUTTING
2023	NC DATA CREATION PARAMETER FOR COMMANDING THREAD CUTTING CYCLE
2024	NC DATA CREATION PARAMETER FOR COMMANDING SPINDLE RPM
2025	NC DATA CREATION PARAMETER FOR CHANGING OVER SPINDLE STAGE NUMBER
2026	NOT USED

Fig. 3(B)

PARAMETER NUMBER	MEANING
2027	NC DATA CREATION PARAMETER FOR DWELL COMMAND
2028	NC DATA CREATION PARAMETER FOR TURNING ON CONSTANT PERIPHERAL SPEED CONTROL
2029	NOT USED
2030	NC DATA CREATION PARAMETER FOR SPINDLE MAXIMUM SPEED CLAMP VALUE COMMAND
2031	NC DATA CREATION PARAMETER FOR FIRST MOTION OF APPROACH BASED ON ONE AXIS SIMULTANEOUSLY
2032	NC DATA CREATION PARAMETER FOR SECOND MOTION OF APPROACH BASED ON ONE AXIS SIMULTANEOUSLY
2033	NC DATA CREATION PARAMETER FOR FIRST MOTION OF RETRACTION BASED ON ONE AXIS SIMULTANEOUSLY
2034	NC DATA CREATION PARAMETER FOR SECOND MOTION OF RETRACTION BASED ON ONE AXIS SIMULTANEOUSLY

Fig. 4

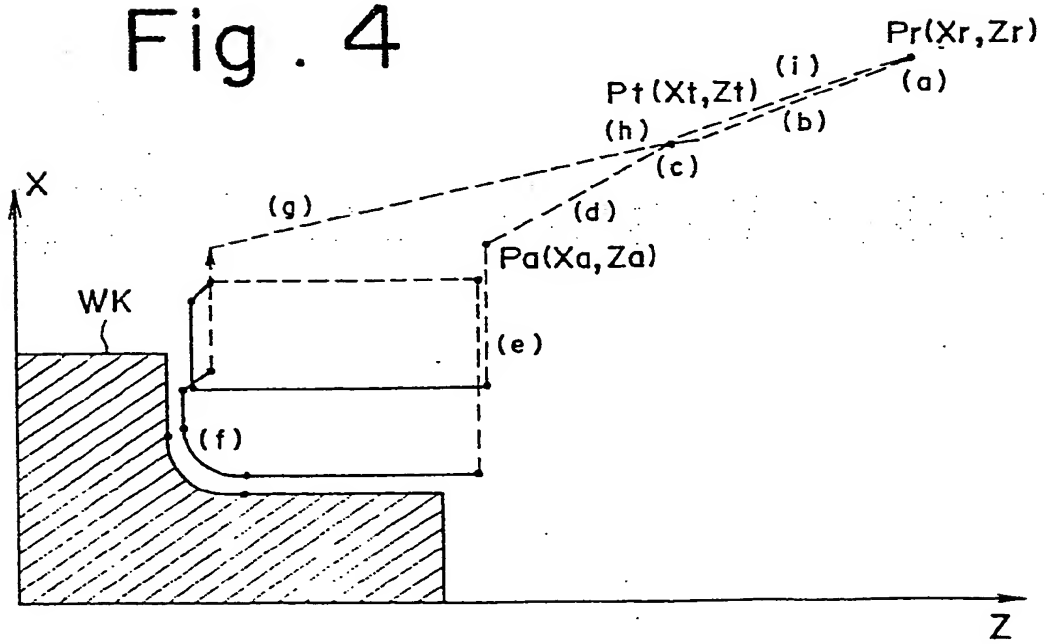

Fig. 5

P	F1	F2	F3	F4	F5	F6	F7	F8	F9
2000	0300	0104	0004	0603	0004	0000	0000	0000	0000
2001	0205	0004	0703	0004	0505	0004	0104	0004	0300
2002	0100	0000	0000	0000	0000	0000			
2003	0100	0000	0000	0000	0000	0000			
2004	0100	0000	0000	0000	0000	0000			
2005	0100	0000	0000	0000	0000	0000			
2006	0100	0000	0000	0000	0000	0000			
2007	0100	0000	0000	0000	0000	0000			
2008	0100	0000	0000	0000	0000	0000			
2009	0003	0004	0605	0004	0000	0000			
2010	0003	0004	0605	0004	0000	0000			
2011	0003	0004	0605	0004	0000	0000			
2012	0003	0004	0605	0004	0000	0000			
2013	0003	0004	0605	0004	0000	0000			
2014	0003	0004	0605	0004	0000	0000			
2015	0003	0004	0605	0004	0000	0000			
2016	4402	1101	0001	0303	0004	0002	0103	0004	
2017	0000	0000	5202	5002	1101	0001	0503	0004	
2018	5202	5002	1101	0001	0000	0305	0004	0000	0000
2019	5202	5002	1101	0001	0000	0405	0004	0000	0000
2020	5202	5102	1101	0001	4401	3301	0503	0004	0000
2021	5202	5102	1101	0001	9901	0503	0004	0000	
2022	5202	0402	1101	0001	6601	0004	0000		
2023	0502	1101	0001	4401	6601	0004	0000		
2024	0002	0105	0004	1005	0203	0005	0004		
2025	0002	0205	0004	0006	0004	0000	0000	0000	
2026	0000	0000	0000	0000	0000	0000	0000		
2027	4002	8801	0004	0000					
2028	0105	0004	0006	0004	1102	0403	0005	0004	0000
2029	1002	0203	0004	0000	0000	0000	0000		
2030	4402	0303	0004	0000					
2031	5202	5002	1101	0001	0000	0305	0004	0000	0000
2032	5202	5002	1101	0001	0000	0305	0004	0000	0000
2033	5202	5002	1101	0001	0000	0405	0004	0000	0000
2034	5202	5002	1101	0001	0000	0405	0004	0000	0000

Fig. 6

FUNCTION CODE	NC DATA OUTPUT FORMAT
0 0 0 0	NO FUNCTION
X X 0 0	FEED OUTPUT XX UNIT FEED OUTPUT
0 0 0 1	Z-AXIS POSITION DATA OUTPUT
1 1 0 1	X-AXIS POSITION DATA OUTPUT
3 3 0 1	Z-AXIS POSITION DATA OUTPUT FOR CENTER OF CIRCULAR ARC
4 4 0 1	X-AXIS POSITION DATA OUTPUT FOR CENTER OF CIRCULAR ARC
⋮	-----
0 0 0 2	G-CODE OUTPUT FOR POSITIONING G00
1 0 0 2	G-CODE OUTPUT FOR LEFT-SIDE OUTPUT G97
4 4 0 2	G-CODE OUTPUT FOR SETTING COORDINATE SYSTEM G50
5 0 0 2	G-CODE OUTPUT FOR POSITIONING OR LINEAR CUTTING G00 or G01
5 1 0 2	G-CODE OUTPUT FOR CLOCKWISE OR COUNTER-CLOCKWISE CIRCULAR ARC CUTTING G02 OR G03
5 2 0 2	G-CODE OUTPUT FOR ABSOLUTE OR INCREMENTAL COMMAND G90 or G91
0 0 0 3	G-CODE OUTPUT FOR TOOL OFFSET CANCEL G40
0 1 0 3	T-CODE OUTPUT TΩΩ
0 2 0 3	S-CODE OUTPUT SΩΩ
0 3 0 3	MAXIMUM RPM CLAMP VALUE S-CODE OUTPUT
0 5 0 3	F-CODE OUTPUT FΩΩ
0 6 0 3	PROGRAM NUMBER OUTPUT
⋮	⋮
0 0 0 4	EOB (END OF BLOCK) OUTPUT EOB
0 1 0 4	EOR (REWIND STOP CODE) OUTPUT %
⋮	⋮
0 0 0 5	M-CODE OUTPUT FOR FORWARD ROTATION OF SPINDLE M03
0 1 0 5	M-CODE OUTPUT FOR STOPPING SPINDLE M05
0 3 0 5	M-CODE OUTPUT FOR TURNING COOLANT ON M08
0 4 0 5	M-CODE OUTPUT FOR TURNING COOLANT OFF M09
0 6 0 5	OPTIONAL STOP OUTPUT M01
⋮	⋮
0 0 0 6	M-CODE OUTPUT FOR SPINDLE RANGE SELECTION
⋮	⋮

INTERNATIONAL SEARCH REPORT

International Application No. PCT/JP83/00390

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl.[3] G05B 19/403

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
I P C	G05B 19/403

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

Jitsuyo Shinan Koho	1926 - 1983
Kokai Jitsuyo Shinan Koho	1971 - 1983

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category*	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
X	JP,A, 57-19809 (Fujitsu Fanuc Ltd.), 2. February. 1982 (02. 02. 82) & EP, A1, 44192	1 - 6

* Special categories of cited documents: [15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search [2]	Date of Mailing of this International Search Report [2]
January 6, 1984 (06. 01. 84)	January 17, 1984 (17. 01. 84)
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Japanese Patent Office	